Code No: 113AC

R13

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year I Semester Examinations, April/May - 2018

MECHANICS OF SOLIDS

(Common to ME, MCT, MMT, AE, AME)

Time: 3 Hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit.
Each question carries 10 marks and may have a, b, c as sub questions.

PART- A

(25 Marks)

1.a) Define resilience and its impact on hardness. [2]
b) Differentiate Sudden, impact and shock loadings. [3]
c) Explain the point of contraflexure. [2]
d) Find the maximum bending moment in a simply supported beam carrying a point load W at a distance 'a' from one end of the span L. [3]
e) Define section modulus and moment of resistance. [2]
f) What assumptions are made in the theory of bending? [3]
g) What are biaxial and triaxial stresses? [2]
h) On what principal is maximum strain theory is based upon? [3]
i) Ratio of diameters of two shafts joined in series is 2. If two shafts have same material and same length, what would be the ratio of their angle of twist? [2]
j) How the thickness of the cylinder is decided whether it is thin or thick? [3]

PART-B

(50 Marks)

2.a) Draw stress-strain curve for Ductile and brittle materials.
b) A straight bar 500mm long is 25 mm diameter for 300 mm length and 15 mm diameter for the remaining length. If the bar is subjected to an axial pull of 15 kN, find the extension of the bar. Take E = 200 Gpa. [5+5]

OR

3. Two equal washers 15 cm apart are compressed between a rigid horizontal base and a rigid horizontal plate by two equal bolts. The bolts are 30cm apart, arranged symmetrically on either side of washers and collinear with them. Initially each bolt is tightened to a tension of 27kN with an extension of 0.0045cm. If the compression of a washer is four times the extension of a bolt for the same load, determine the increase in tension in one bolt when the other one is further tightened to 36kN. [10]

4. Draw the S.F. and B.M. diagrams for the propped cantilever as shown in Figure 1 and find the position and magnitude of the maximum B.M. [10]

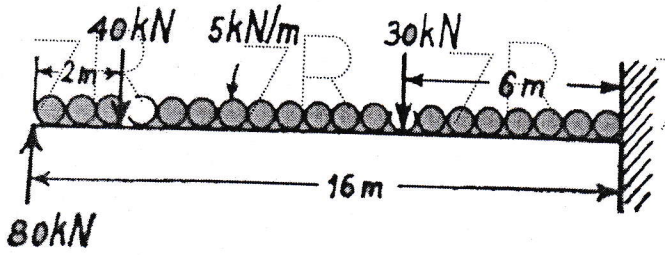

Figure: 1

OR

5. Construct the axial thrust, shear force and bending moment diagrams for the beam loaded as shown in Figure 2. [10]

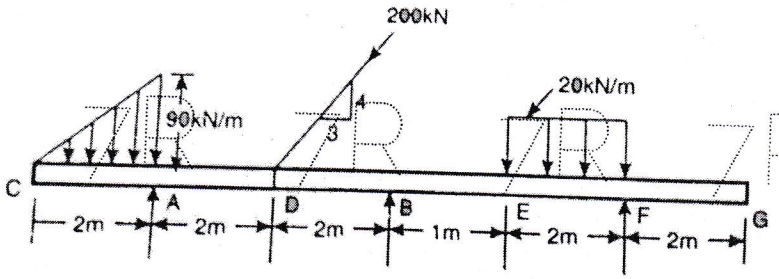

Figure: 2

6. A beam AB supported at its ends has a span of 2 m carries a uniformly distributed load of 200 kN/m over the entire span. The cross section of the beam is a T-section, having flange width 125 mm, flange thickness 25 mm, web thickness 25 mm and overall depth 200 mm. Calculate the maximum shear stress in the beam. Also draw the shear stress distribution marking principal values. [10]

OR

7. A horizontal cantilever 2.5m long is of rectangular cross-section 50mm wide throughout its length and depth varying from 50mm to 150mm at the fixed end. A load of 3kN acts at the free end. Find the position of the highest stressed section and the value of maximum bending stress induced. [10]

8. A thick cylinder shell of 300-mm inside diameter is to withstand an internal pressure of 30Mpa. The allowable tensile stress for the material of the shell is 150Mpa. Determine the thickness of shell on the basis of following theories of failure neglecting the longitudinal direct stress:
a) Maximum principal stress theory
b) Maximum shear stress theory
c) Maximum principal strain theory
d) Maximum strain energy theory
Poisson's ratio =0.3. [10]

OR

9. Derive the various design parameters using Mohr's circle. [10]

10. A solid alloy shaft of 60mm diameter is coupled in series with a hollow steel shaft of the same outside diameter. Determine the inside diameter of the steel shaft if the angle of twist per unit length is 7% of that of the alloy shaft. What is the speed at which the shaft transmits 420kW of power? The permissible value of shear stresses in the alloy and steel shaft are 65 MPa and 80 MPa respectively. $G_s=2G_{alloy}$. [10]

OR

11. A closed-end copper tube of 72 mm internal diameter, 800 mm long and 2 mm thick is filled with water under pressure. Find the change in pressure if additional volume of 4000 mm^3 of water is pumped into the tube. Neglect any distortion of the end plates. Take E=102 GPa, K=2200 MPa and Poisson's ratio =0.3. [10]

---ooOoo---